

WO 2005/007691

1/37

SEQUENCE LISTING

<110> INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

<120> EAST COAST FEVER VACCINE BASED ON CTL-SPECIFIC
SCHIZONT ANTIGENS

<130> 41860-205200

<140>

<141>

<150> 60/486,750

<151> 2003-07-14

<160> 77

<170> PatentIn Ver. 3.2

<210> 1

<211> 543

<212> PRT

<213> Theileria parva

<400> 1

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			20					25					30			
Glu	Lys	Glu	Glu	Glu	Leu	Lys	Pro	Pro	Ser	Ala	Leu	Glu	Asp	Glu	Leu	
		35					40						45			
Lys	Lys	Arg	Glu	Glu	Glu	Ser	Arg	Lys	Arg	Met	Glu	Glu	Met	Gln	Lys	
		50				55					60					
Glu	Ile	Leu	Glu	Lys	Lys	Leu	Arg	Glu	Gly	Lys	Lys	Ala	Leu	Glu	Glu	
65					70				75						80	
Leu	Glu	Lys	Arg	Glu	Lys	Glu	Val	Val	Asp	Glu	Phe	Ala	Lys	His	Leu	
				85					90					95		
Lys	Lys	Pro	Glu	Glu	Arg	Leu	Pro	Lys	Ile	Ile	Leu	Thr	Leu	Asp	Ser	
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		115					120					125				
Val	Ala	Val	Ser	Lys	Thr	Thr	Phe	Thr	Ser	Asp	Ser	Asp	Leu	Val	Asp	
		130				135					140					
Phe	Thr	His	Thr	Leu	Leu	Gly	Ile	Lys	Phe	Leu	Val	Thr	Gly	Val	Gln	
145					150					155					160	
Phe	Gly	Gly	Lys	Thr	Tyr	Thr	Ile	Lys	Pro	Ile	Glu	Ala	Thr	Met	Ala	
				165					170						175	

2/37

Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe Leu Leu
 180 185 190
 Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp Gly Asp
 195 200 205
 Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu Met Leu
 210 215 220
 Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu Ile Pro
 225 230 235 240
 Ala Pro Pro Gly Val Lys Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr
 245 250 255
 Ile Thr Pro Ser Val Pro Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser
 260 265 270
 Ala Pro Pro Thr Thr Pro Pro Thr Gly Leu Asn Phe Asn Leu Thr Val
 275 280 285
 Gln Asn Lys Phe Met Ile Gly Ser Gln Glu Val Lys Leu Asn Ile Thr
 290 295 300
 His Glu Tyr Glu Gly Val Tyr Glu Ala His Lys Tyr Phe Ile Glu Arg
 305 310 315 320
 Gly Ser Phe Thr Pro Thr Ser Phe Ser Ile Gly Asp Leu Pro Gln Thr
 325 330 335
 Gly Leu Pro Val Asn Gln Thr Val Asp Thr Ile Val Val Tyr Phe His
 340 345 350
 Arg Val Thr Met Gly Glu Pro Val Gly Ile Pro Leu Ile Val Leu Ile
 355 360 365
 Phe Tyr Lys Asn Gln Ser Arg Lys Tyr Leu Asn Lys Gly Asn Gly Asn
 370 375 380
 Trp Glu Glu Ser Lys Ala Leu Leu Phe Arg Glu Glu Leu Asp Tyr Leu
 385 390 395 400
 Asp Ser Ile Phe Asn Asp Phe Val Thr Val Asn Leu Ser Arg Arg Ser
 405 410 415
 Asp Tyr Tyr Arg Asn Gly Thr Gly Thr Ser Glu Ile Glu Gln Thr Leu
 420 425 430
 Asp Met Asn Val Tyr Val Glu Pro Asp Thr Pro Cys Ala Gly Trp Thr
 435 440 445
 Thr Tyr Ile His Lys Leu Glu Glu Gly Gly Glu Gly Ile Glu Lys
 450 455 460

Pro Phe Gln Ile Arg Gln Leu Trp Phe Ser Lys Gln Lys Phe Asp Ile
465 470 475 480

Phe Pro Met Gly Lys Val Ser Ile Val Asn Val Tyr Gly Lys Asn Asp
485 490 495

Glu Pro Leu Ser Tyr Ala Pro Ser Ile Phe Ser Val Ile Arg Glu Asp
500 505 510

Gly Ile Gln Ile Phe Tyr Val Arg Ala Tyr Ser Gln Tyr Leu Leu Asp
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Ser Ser Val Asn Pro Gln Asn Leu Pro Gln Lys Leu Asn Thr Leu
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<213> Theileria parva

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Gln Ala Ile Val Asp Cys Val Lys Thr Thr Leu Gly Pro Arg Gly Met
35 40 45

Asp Lys Leu Ile His Thr Glu Arg Asp Val Thr Ile Thr Asn Asp Gly
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Ala Thr Val Leu Lys Leu Leu Asp Ile Thr His Pro Ala Ala Ser Val
65 70 75 80

Leu Val Asp Ile Ala Lys Ser Gln Asp Asp Glu Val Gly Asp Gly Thr
85 90 95

Thr Ser Val Thr Val Leu Ala Gly Glu Leu Leu Asn Glu Ala Lys Ala
100 105 110

Phe Ile Leu Asp Gly Ile Ser Pro Gln Val Ile Ile Lys Tyr Tyr Arg
115 120 125

Glu Ala Cys Gln Val Ala Leu Asn Leu Ile Asp Lys Val Ala Ile His
130 135 140

Leu Ser Asn Lys Ser Ser Thr Asp Lys Lys Glu Leu Leu Ile Lys Cys
145 150 155 160

Ala Glu Thr Thr Phe Asn Ser Lys Leu Leu Ser Gly Tyr Lys Thr Phe
165 170 175

Phe Ala Lys Met Val Val Glu Ala Val Ala Thr Leu Asp Glu Asp Leu
180 185 190

Asp Glu Asp Met Ile Gly Val Lys Lys Val Thr Gly Gly Ser Cys Glu
 195 200 205
 Asp Ser Leu Leu Val Lys Gly Val Ala Phe Lys Lys Thr Phe Ser Tyr
 210 215 220
 Ala Gly Ala Glu Gln Gln Pro Lys Lys Phe Val Asn Pro Lys Ile Leu
 225 230 235 240
 Leu Leu Asn Leu Glu Leu Glu Leu Lys Ser Glu Lys Glu Asn Ala Glu
 245 250 255
 Ile Val Ile Asn Asn Pro Gln Glu Tyr Gln Lys Ile Ile Asp Ala Glu
 260 265 270
 Tyr Arg Ile Ile Phe Glu Lys Leu Glu Asn Ala Val Lys Leu Gly Ala
 275 280 285
 Asn Val Val Leu Ser Lys Leu Pro Ile Gly Asp Leu Ala Thr Gln Tyr
 290 295 300
 Phe Ala Asp Lys Asn Val Phe Cys Ala Gly Arg Val Asp Glu Asn Asp
 305 310 315 320
 Leu Ile Arg Thr Ser Lys Ala Thr Gly Ala Ser Ile Gln Thr Thr Leu
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 Asn Asn Leu Ser Val Asp Val Leu Gly Thr Cys Gly Val Phe Glu Glu
 340 345 350
 Val Gln Ile Gly Ser Glu Arg Tyr Asn Met Phe Thr Asp Cys Lys Ser
 355 360 365
 Ala Lys Thr Cys Thr Ile Val Leu Arg Gly Gly Gly Gln Gln Phe Ile
 370 375 380
 Asp Glu Ser Glu Arg Ser Leu His Asp Ala Ile Met Ile Val Arg Arg
 385 390 395 400
 Ala Thr Lys Cys Asn Thr Ile Leu Pro Gly Ala Gly Ala Ile Glu Met
 405 410 415
 Leu Leu Ser Thr Tyr Leu Leu His Tyr Ser Leu Asn Thr Ile Asn Pro
 420 425 430
 Thr Asp Ser Val Asn His Val Asn Cys Val Asn Ser Val Asn His Val
 435 440 445
 Asn Gly Val Thr Gly Val Asn Lys Ser Leu Val Gly Lys Arg His Ile
 450 455 460
 Ile Met Asn Gly Phe Ala Lys Ala Leu Glu Cys Ile Pro Arg Asn Leu
 465 470 475 480
 Ala Thr Asn Ser Gly Tyr Asn Ser Asn Asp Leu Leu Ser Ile Leu Arg
 485 490 495

5/37

Asn Lys Tyr Asn Gln Leu Glu Ile Val Asn Gly Glu Ile Lys Val Asn
 500 505 510
 Asn Glu Glu Ser Trp Tyr Gly Ile Asp Cys Tyr Lys Gly Ser Val Cys
 515 520 525
 Asn Ala Tyr Lys Ala Cys Ile Trp Glu Pro Ser Leu Val Lys Lys Asn
 530 535 540
 Ser Ile Tyr Ser Ala Thr Glu Ala Ala Cys Leu Val Leu Ser Val Asp
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 Glu Thr Val Lys Asn Gln Ser Arg Gln Gln Leu Gln Ser Ala Leu Pro
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 Gln Pro Lys

<210> 3
 <211> 155
 <212> PRT
 <213> Theileria parva

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 35 40 45
 Ala Tyr Cys Phe Asp Gly Thr Lys Arg Leu Cys His Ile Arg Gly Lys
 50 55 60
 Met Arg Lys Arg Val Trp Val Asn Ala Gly Asp Ile Ile Leu Val Ser
 65 70 75 80
 Leu Arg Asp Phe Gln Asp Ser Lys Ala Asp Val Ile Ala Lys Tyr Thr
 85 90 95
 Ala Glu Glu Ala Arg Thr Leu Lys Ala Tyr Gly Glu Leu Pro Glu Ala
 100 105 110
 Thr Lys Ile Asn Glu Thr Asp Val Tyr Asp Asp Glu Ala Asp Asn Cys
 115 120 125
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 Gln Glu Glu Ser Asp Phe Asp Ile Asp Asp Leu
 145 150 155

6/37

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 35 40 45
 Leu Glu Lys Ile Arg Tyr Glu Ala Ile Lys Asp Pro Lys Gln Ile Glu
 50 55 60
 Asp Gln Pro Asp Tyr Tyr Ile Arg Leu Tyr Ala Asp Lys Asn Asn Asn
 65 70 75 80
 Thr Leu Thr Ile Glu Asp Ser Gly Ile Gly Met Thr Lys Ala Asp Leu
 85 90 95
 Val Asn Asn Leu Gly Thr Ile Ala Lys Ser Gly Thr Arg Ala Phe Met
 100 105 110
 Glu Ala Leu Gln Ala Gly Ser Asp Met Ser Met Ile Gly Gln Phe Gly
 115 120 125
 Val Gly Phe Tyr Ser Ala Tyr Leu Val Ala Asp Lys Val Thr Val Val
 130 135 140
 Ser Lys Asn Asn Ala Asp Asp Gln Tyr Val Trp Glu Ser Thr Ala Ser
 145 150 155 160
 Gly His Phe Thr Val Lys Lys Asp Asp Ser His Glu Pro Leu Lys Arg
 165 170 175
 Gly Thr Arg Leu Ile Leu His Leu Lys Glu Asp Gln Thr Glu Tyr Leu
 180 185 190
 Glu Glu Arg Arg Leu Lys Glu Leu Val Lys Lys His Ser Glu Phe Ile
 195 200 205
 Ser Phe Pro Ile Ser Leu Ser Val Glu Lys Thr Gln Glu Thr Glu Val
 210 215 220
 Thr Asp Asp Glu Ala Glu Leu Asp Glu Asp Lys Lys Pro Glu Glu Glu
 225 230 235 240
 Lys Pro Lys Asp Asp Lys Val Glu Asp Val Thr Asp Glu Lys Val Thr
 245 250 255
 Asp Val Thr Asp Glu Glu Glu Lys Lys Glu Glu Lys Lys Lys Lys Lys
 260 265 270

7/37

Arg	Lys	Val	Thr	Asn	Val	Thr	Arg	Glu	Trp	Glu	Met	Leu	Asn	Lys	Gln	275	280	285
Lys	Pro	Ile	Trp	Met	Arg	Leu	Pro	Ser	Glu	Val	Thr	Asn	Glu	Glu	Tyr	290	295	300
Ala	Ala	Phe	Tyr	Lys	Asn	Leu	Thr	Asn	Asp	Trp	Glu	Asp	His	Leu	Ala	305	310	315
Val	Lys	His	Phe	Ser	Val	Glu	Gly	Gln	Leu	Glu	Phe	Lys	Ala	Leu	Leu	325	330	335
Phe	Val	Pro	Arg	Arg	Ala	Pro	Phe	Asp	Met	Phe	Glu	Ser	Arg	Lys	Lys	340	345	350
Lys	Asn	Asn	Ile	Lys	Leu	Tyr	Val	Arg	Arg	Val	Phe	Ile	Met	Asp	Asp	355	360	365
Cys	Glu	Glu	Leu	Ile	Pro	Glu	Trp	Leu	Ser	Phe	Val	Lys	Gly	Val	Val	370	375	380
Asp	Ser	Glu	Asp	Leu	Pro	Leu	Asn	Ile	Ser	Arg	Glu	Thr	Leu	Gln	Gln	385	390	395
Asn	Lys	Ile	Leu	Lys	Val	Ile	Arg	Lys	Asn	Leu	Val	Lys	Lys	Cys	Leu	405	410	415
Glu	Leu	Phe	Asn	Glu	Leu	Thr	Glu	Lys	Lys	Glu	Asp	Phe	Lys	Lys	Phe	420	425	430
Tyr	Glu	Gln	Phe	Ser	Lys	Asn	Leu	Lys	Leu	Gly	Ile	His	Glu	Asp	Asn	435	440	445
Ala	Asn	Arg	Ser	Lys	Ile	Ala	Glu	Leu	Leu	Arg	Phe	Glu	Thr	Thr	Lys	450	455	460
Ser	Gly	Asp	Glu	Leu	Val	Ser	Leu	Lys	Glu	Tyr	Val	Asp	Arg	Met	Lys	465	470	475
Ser	Asp	Gln	Lys	Tyr	Val	Tyr	Tyr	Ile	Thr	Gly	Glu	Ser	Lys	Gln	Ser	485	490	495
Val	Ala	Ser	Ser	Pro	Phe	Leu	Glu	Thr	Leu	Arg	Ala	Arg	Asp	Tyr	Glu	500	505	510
Val	Leu	Tyr	Met	Thr	Asp	Pro	Ile	Asp	Glu	Tyr	Ala	Val	Gln	Gln	Ile	515	520	525
Lys	Glu	Phe	Glu	Gly	Lys	Lys	Leu	Lys	Cys	Cys	Thr	Lys	Glu	Gly	Leu	530	535	540
Asp	Leu	Asp	Glu	Gly	Glu	Asp	Glu	Lys	Lys	Ser	Phe	Glu	Ala	Leu	Lys	545	550	555
Glu	Glu	Met	Glu	Pro	Leu	Cys	Lys	His	Ile	Lys	Glu	Val	Leu	His	Asp	565	570	575

8/37

Lys Val Glu Lys Val Val Cys Gly Thr Arg Phe Thr Asp Ser Pro Cys
 580 585 590
 Ala Leu Val Thr Ser Glu Phe Gly Trp Ser Ala Asn Met Glu Arg Ile
 595 600 605
 Met Lys Ala Gln Ala Leu Arg Asp Ser Ser Ile Thr Ser Tyr Met Leu
 610 615 620
 Ser Lys Lys Ile Met Glu Ile Asn Pro Arg His Ser Ile Met Lys Glu
 625 630 635 640
 Leu Lys Thr Arg Ala Ala Asn Asp Lys Thr Asp Lys Thr Val Lys Asp
 645 650 655
 Leu Val Trp Leu Leu Tyr Asp Thr Ala Leu Leu Thr Ser Gly Phe Asn
 660 665 670
 Leu Asp Glu Pro Thr Gln Phe Gly Asn Arg Ile Tyr Arg Met Ile Lys
 675 680 685
 Leu Gly Leu Ser Leu Asp Asp Glu Glu His Val Glu Glu Asp Ser Ser
 690 695 700
 Met Pro Pro Leu Asp Glu Pro Val Val Asp Ser Lys Met Glu Glu Val
 705 710 715 720
 Asp

<210> 5
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 <212> PRT
 <213> Theileria parva

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 Leu Ser Ser Val Thr Phe Leu His Ile Ala Lys Met Glu Glu Val Glu
 20 25 30
 Asn Val Lys Val Asp Ala Leu Glu Arg Val Asp Thr Glu Ser Val Leu
 35 40 45
 Asn Tyr Asp Thr Val Leu Glu Lys Lys Pro Leu Arg Ser Ser Val Ala
 50 55 60
 Ser Phe Phe Lys Arg Tyr Ser Ala Val Leu Val Ile Leu Thr Ala Val
 65 70 75 80
 Leu Leu Phe Thr Phe Thr Phe Ala Ala Ile Ala Leu Ser Ser Gly Arg
 85 90 95
 Ser Ala Ile Arg Lys Asn Arg Glu Leu Leu Ser Val Glu Phe Glu Lys
 100 105 110

9/37

Leu Gln Phe Asp Asn Phe Val Thr Ile Lys Gly Glu Arg Glu Glu Asp
 115 120 125
 Phe Pro Lys Met Val Ala Glu Val Leu Tyr Lys Val Ala Val Glu Phe
 130 135 140
 Asp Pro Lys Glu Glu Ala Leu Ile Tyr Val Gln Phe Asn Asp Phe Asn
 145 150 155 160
 Lys Gln His Asp Lys Lys His Asn Asn Tyr Arg His Lys Lys Thr Ser
 165 170 175
 Tyr Thr Asn Phe Arg Asn Asn Leu Asn Asp Ile Asn Glu His Asn Ala
 180 185 190
 Lys Pro Asn Leu Ser Tyr Thr Lys Asn Met Asn His Phe Gly Asp Ile
 195 200 205
 Ser Ser Lys Asp Phe Met Lys Arg Tyr Thr Lys Lys Val Leu Leu Asn
 210 215 220
 Leu Pro Lys Asp His Val Ser Thr Tyr Asn Asn Asn Arg Pro Met Ser
 225 230 235 240
 Val Asp Leu Arg Ser His Gly Val Leu Thr Pro Val Lys Cys Gln Glu
 245 250 255
 Glu Asn Glu Leu Ser Trp Pro Tyr Ser Val Val Ala Val Ala Glu Ser
 260 265 270
 Phe Val Lys Lys Thr Ser Gln Lys Thr Val Ser Leu Ser Glu Lys Gln
 275 280 285
 Leu Val Asp Cys Val Thr Asp Lys Lys Ser Ala Asn Asn Pro Phe Leu
 290 295 300
 Gly Tyr Lys Tyr Leu Lys Asp Leu Gly Leu Phe Glu Ser Glu Leu Val
 305 310 315 320
 Asp Lys Ser Thr Thr Lys Cys Pro Ala Leu Glu Gly Glu Arg Phe Lys
 325 330 335
 Val Pro Ser Tyr Ser Tyr Ser Tyr Glu Pro Asp Leu Val Ala Leu Leu
 340 345 350
 Leu Asn Ala Gly Pro Leu Thr Val Pro Val Ala Val Ser Glu Asp Trp
 355 360 365
 Gln Phe Tyr Ala Asp Gly Thr Leu Asp Val Cys Gly Ala Glu Leu Asn
 370 375 380
 His Phe Leu Thr Leu Val Gly Val Ser Phe Asp Glu Lys Gly Asn His
 385 390 395 400
 Trp Ile Leu Lys Asn Ser Phe Gly Glu Gly Trp Gly Asn Lys Gly Tyr
 405 410 415

10/37

Leu Leu Leu Thr Arg Asn Ser Lys Glu Tyr Lys Asp Asp Cys Gly Leu
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Thr Ser Phe Ala Val Tyr Ala Val
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<210> 6

<211> 543

<212> PRT

<213> Theileria parva

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Glu Lys Glu Glu Glu Lys Pro Pro Ser Ala Leu Glu Asp Glu Leu
 35 40 45

Lys Lys Arg Glu Glu Glu Ser Arg Lys Arg Met Glu Glu Met Gln Lys
 50 55 60

Glu Ile Leu Glu Lys Lys Leu Arg Glu Gly Lys Lys Ala Leu Glu Glu
 65 70 75 80

Leu Glu Lys Arg Glu Lys Glu Val Val Asp Glu Phe Ala Lys His Leu
 85 90 95

Lys Lys Pro Glu Glu Arg Leu Pro Lys Ile Ile Leu Thr Leu Asp Ser
 100 105 110

Gly Phe Pro Thr Val Asp Pro Ile Thr Tyr Thr Ser Gly Val Tyr Met
 115 120 125

Val Ala Val Ser Lys Thr Thr Phe Thr Ser Asp Ser Asp Leu Val Asp
 130 135 140

Phe Thr His Thr Leu Leu Gly Ile Lys Phe Leu Val Thr Gly Val Gln
 145 150 155 160

Phe Gly Gly Lys Thr Tyr Thr Ile Lys Pro Ile Glu Ala Thr Met Ala
 165 170 175

Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe Leu Leu
 180 185 190

Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp Gly Asp
 195 200 205

Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu Met Leu
 210 215 220

11/37

Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu Ile Pro
 225 230 235 240
 Ala Pro Pro Gly Val Lys Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr
 245 250 255
 Ile Thr Pro Ser Val Pro Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser
 260 265 270
 Ala Pro Pro Thr Thr Pro Pro Thr Gly Leu Asn Phe Asn Leu Thr Val
 275 280 285
 Gln Asn Lys Phe Met Ile Gly Ser Gln Glu Val Lys Leu Asn Ile Thr
 290 295 300
 His Glu Tyr Glu Gly Val Tyr Glu Ala His Lys Tyr Phe Ile Glu Arg
 305 310 315 320
 Gly Ser Phe Thr Pro Thr Ser Phe Ser Ile Gly Asp Leu Pro Gln Thr
 325 330 335
 Gly Leu Pro Val Asn Gln Thr Val Asp Thr Ile Val Val Tyr Phe His
 340 345 350
 Arg Val Thr Met Gly Glu Pro Val Gly Ile Pro Leu Ile Val Leu Ile
 355 360 365
 Phe Tyr Lys Asn Gln Ser Arg Lys Tyr Leu Asn Lys Gly Asn Gly Asn
 370 375 380
 Trp Glu Glu Ser Lys Ala Leu Leu Phe Arg Glu Glu Leu Asp Tyr Leu
 385 390 395 400
 Asp Ser Ile Phe Asn Asp Phe Val Thr Val Asn Leu Ser Arg Arg Ser
 405 410 415
 Asp Tyr Tyr Arg Asn Gly Thr Gly Thr Ser Glu Ile Glu Gln Thr Leu
 420 425 430
 Asp Met Asn Val Tyr Val Glu Pro Asp Thr Pro Cys Ala Gly Trp Thr
 435 440 445
 Thr Tyr Ile His Lys Leu Glu Glu Gly Gly Glu Gly Gly Ile Glu Lys
 450 455 460
 Pro Phe Gln Ile Arg Gln Leu Trp Phe Ser Lys Gln Lys Phe Asp Ile
 465 470 475 480
 Phe Pro Met Gly Lys Val Ser Ile Val Asn Val Tyr Gly Lys Asn Asp
 485 490 495
 Glu Pro Leu Ser Tyr Ala Pro Ser Ile Phe Ser Val Ile Arg Glu Asp
 500 505 510
 Gly Ile Gln Ile Phe Tyr Val Arg Ala Tyr Ser Gln Tyr Leu Leu Asp
 515 520 525

12/37

Ser Ser Val Asn Pro Gln Asn Leu Pro Gln Lys Leu Asn Thr Leu
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<212> PRT

<213> Theileria parva

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Glu Ile Leu Glu Lys Lys Leu Arg Glu Gly Lys Lys Ala Leu Glu Glu
 65 70 75 80

Leu Glu Lys Arg Glu Lys Glu Val Val Asp Glu Phe Ala Lys His Leu
 85 90 95

Lys Lys Pro Glu Glu Arg Leu Pro Lys Ile Ile Leu Thr Leu Asp Ser
 100 105 110

Gly Phe Pro Thr Val Asp Pro Ile Thr Tyr Thr Ser Gly Val Tyr Met
 115 120 125

Val Ala Val Ser Lys Thr Thr Phe Thr Ser Asp Ser Asp Leu Val Asp
 130 135 140

Phe Thr His Thr Leu Leu Gly Ile Lys Phe Leu Val Thr Gly Val Gln
 145 150 155 160

Phe Gly Gly Lys Thr Tyr Thr Ile Lys Pro Ile Glu Ala Thr Met Ala
 165 170 175

Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe Leu Leu
 180 185 190

Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp Gly Asp
 195 200 205

Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu Met Leu
 210 215 220

Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu Ile Pro
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1 5 10

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14/37

<400> 13

Gln Ser Leu Val Cys Val Leu Met Lys
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<400> 15

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Cys Gly Ala Glu Leu Asn His Phe Leu
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<210> 18

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<212> DNA

<213> Theileria parva

<400> 18

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tctttgatta tatttaattt cgtaggaaa agaccgaaa aagaagagga actcaaact 240
ccttctgcat tagaagatga acttaaaaaa cgtgaagaag aaagccgaaa acgcatggaa 300
gaaatgcaa aggaaattct cgaaaaaaag ttaagagaag gtaaaaaagc cttggaagaa 360

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cttgaaaaac gtgaaaaaga agtggttagat gagtttgcaa aacacctcaa aaaacctgaa 420
gaaagacttc ctaaaattat tcttacattg gattccgggt ttccaacagt tgatcctatt 480
acataacttt caggagttta tatggttagca gttagtaaaa caactttttac ctgagattca 540
gatcttggtg attttactca cacactgctg ggcataaagt ttctagttac tgggtgtaca 600
tttggtggga aaacatacac aattaaaccg attgaagcta ctatggccac ttcaattgca 660
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ggaattgaaa aaccttttca aattagacaa ttatggttta gtaaacagaa atttgatata 1560
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gcttactcac agtacttgct tgattcaagt gttaatcccc aaaatttacc tcaaaaatta 1740
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aaaaaaaaa 1807

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<210> 19

<211> 1740

<212> DNA

<213> Theileria parva

<400> 19

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ggccaagctc aaatcatttag taatatcaac gcctgtcaag ctattgtcga ttgtgttaaa 120
actactctag gtccctagagg aatggacaag ttgatacata cggagagaga tgtgacgata 180
accaatgacg gtgctactgt tttgaaatta cttgatatta ctcatcctgc cgcttctgtt 240
cttggtgata tgcgtaaatc acaagatgat gaagtcgggtg atgggactac ttccgttact 300
gttctagcag gtgagttatt gaatgaagct aaggcggtta tattggatgg gataagtcct 360
caggttatca taaaatacta tcgtgaagcc tgtcaagttg ctttaaactc cattgataaa 420
gttgccattc atctctccaa caaatcctca actgataaga aagaactact gataaaatgt 480
gctgaaacta cttttaattc aaagttattg tctgggtata aaaccttttt tgccaagatg 540
gttggtggagg cagtggctac tttggatgag gacttggatg aggatatgat tgggtgttaa 600
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actttcagct acgctggggc tgaacaacag ccaaagaaat tcgtcaatcc aaagatttta 720
ttacttaatt tggaaattgga actcaaatcc gaaaaagaaa acgcagaaat tgttatcaat 780
aatccacaag aatatcagaa gataatagat gccgagtata ggataatatt tgagaagctt 840
gagaatgcag tgaaactcgg tgctaagtga gttttatcta aattgccaat tgggtgattta 900
gcaacacaat actttgcaga taaaaatgta ttttgtgccg gccgggttga tgaaaatgat 960
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tgcgtaactc ccgtaaatca tgtaaatgga gttactgggg tgaataagag tctgggtgggt 1380
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16/37

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gccactaatt ctggctacaa ttcaaagtat ttattatcga tactaagaaa taaatacaat 1500
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gattgttaca aggggaagtgt atgtaacgca tacaaggctt gtatttggga gccgagtttg 1620
gtgaaaaaaa actcaattta ctcagctact gaagcagctt gccttgttct ctcagttgat 1680
gaaactgtca aaaaccaatc cagacaacag ttacaaagcg cactaccaca acccaaataa 1740

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<210> 20
 <211> 468
 <212> DNA
 <213> Theileria parva

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<400> 20
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atgctcggtta atggcagact tgaagcctac tgttttgacg gcactaaacg tctttgccat 180
attagaggaa agatgaggaa gcgagtttgg gtaaatgccg gcgatattat tttggtatcg 240
cttagagatt tccaggacag caaggctgac gtgatcgcaa agtacactgc tgaggaggct 300
cgtactctga aggcttacgg cgagttgcct gaagcgacca aaatcaacga aactgacgtg 360
tacgacgacg aggccgacaa ctgcattgac ttccaggacg tatcgtctga atcagaacct 420
gaggatgagt cacaagagga gtcggatttc gatatcgatg atttataa 468

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<210> 21
 <211> 2166
 <212> DNA
 <213> Theileria parva

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<400> 21
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ctcattagca acgctagcga cgcactggaa aaaattaggt atgaggcaat caaggatcca 180
aagcaaactc aggatcaacc cgattactat atcagggtgt atgccgacaa gaacaacaac 240
acctcacaa tcgaagattc cggatttggc atgaccaaag ccgacctcgt gaacaacctc 300
ggtacaattg ccaaattccg cacaagagca ttcatggagg cactgcaagc aggctcggac 360
atgtcaatga tcggacagtt tgggtgtcgt ttctactcag catacctggt cgcagataag 420
gtgacagtag tgtccaagaa caacgcagac gaccagtacg tctgggagtc aacagcctca 480
ggccacttta cagtgaagaa ggacgactcg caccgagccg tcaaaagagg aactagacta 540
atactgcact tgaaggagga ccaaactgag taccttgagg agagaaggct gaaagagctt 600
gttaagaagc acagcgagtt catttcattc ccaatctcgc tctcagtaga gaagaccag 660
gagaccgagg tcactgacga cgaggcagag ctgacgagg acaagaagcc cgaggaggag 720
aagcccaagg acgataaggt ggaggacggt actgacgaga aagtgaccga cgtcactgac 780
gaggaggaga aaaaggagga aaagaaaaag aagaagagga aggtcaccaa cgtaacgcgt 840
gagtgggaaa tgcttaacaa gcagaagcca atttggatga gactcccgtc tgaagtcacc 900
aacgaagaat atgcagcgtt ctacaagaac ttaaccaacg attgggaaga ccacttggcc 960
gtgaaacact tcagcgttga gggtcagctt gaggttcaaag ctctactgtt cgtcccaaga 1020
agagcgccgt ttgacatggt cgagtcccgc aaaaagaaaa acaacatcaa gttgtacgtc 1080
agacgcgtat ttatcatgga cgactgtgag gagctcatcc cggagtgggt ttcccttgtg 1140
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aacaagatcc tcaaggatcat caggaagaac ttggtgaaaa agtgcctcga gctcttcaat 1260
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cctttccttg agacctgag ggctcgcgac tacgaagtcc tgtacatgac tgaccaatt 1560
gatgagtacg cagttcagca gatcaaggag tttgaaggca agaaactcaa gtgctgtacc 1620
aaggagggcc tggaccttga tgagggcgag gatgaaaaga agtccttga agcgtcaag 1680

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17/37

gaagaaatgg aacctctttg caagcacatc aaggaagtgc tccacgacaa ggtggaaaag 1740
gtcgtgtgtg gaacaagggt taccgactct ccatgcgcac ttgtcaccag cgagttcggc 1800
tggagcgcga acatggagcg tatcatgaaa gcacaagctc tcagagactc gtccataaca 1860
agctacatgc tgagcaagaa gatcatggag attaacccga gacatagcat catgaaggag 1920
ctcaaaacta gagctgcaaa cgacaaaaca gataaaaccg tcaaggacct agtctggctt 1980
ctctacgaca cagcgtctctt aacctcaggg tttaacctcg atgagcccac ccagtttggg 2040
aacaggatct acaggatgat caagctcgga ctctcattgg acgacgagga acacgtagaa 2100
gaggactcat caatgccgcc gctggatgag cccgttgtcg actccaaaat ggaggaagtt 2160
gactaa 2166

<210> 22

<211> 1323

<212> DNA

<213> Theileria parva

<400> 22

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acattcttac atattgctaa aatggaagaa gtagaaaacg taaaagtcga cgccttggag 120
cgtgttgaca ctgagctctgt ccttaattat gacactgtgt tagaaaagaa accattgctc 180
agcagtgttg cctctttctt caaaagatac agtgctgttc tcgtaatat aactgccgtg 240
ctattattca cattcacttt tgcagcaata gcattgtcat caggcagaag cgcaatcaga 300
aagaacagag aactcctgtc agtcgaattt gaaaagcttc agttcgataa ttctgtgaca 360
attaagggag aaaggggaaga ggacttcccc aagatggtag ctgaagttct ttacaagggt 420
gcagtgcagt ttgacccaaa agaagaggcc ttgatctacg tccagttcaa tgacttcaac 480
aagcaacacg acaagaagca caacaattac aggcacaaga agacctcgta caccaacttc 540
agaaaacaacc ttaatgatata aaacgagcac aacgcaaaac caaacctgtc gtacaccaag 600
aacatgaacc acttcggtga catatcatcc aaggatttca tgaagagata caccaagaaa 660
gtactcttga acttgccaaa agaccacgtg tccacctata acaacaacag accaatgtca 720
gttgatctca gaagccatgg tgtattgact ccagtcaggt gccaagaaga aaatgaactc 780
tcatggccat actccgtagt agcagtcgcc gagtcattcg ttaagaagac atcacaaaag 840
accgtatccc tcagcgaaaa acaattagta gattgctgta cagataagaa atctgcaaac 900
aaccattctt tgggttacaa ataccttaag gacttgggtc tgttcgaatc agaactcgta 960
gacaaaatcca caaccaagtg cccagcattg gaaggtgaaa gattcaaaag cccatcatac 1020
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gctgaattga accacttctt gaccctagta ggtgtcagct ttgacgaaaa aggcaatcac 1200
tggatactca aaaactcatt cgggtgaaggc tggggaaaca agggatacct actgttgact 1260
cgcaatagca aggaatacaa agatgattgt ggattgacct ccttcgcagt gtacgcagtt 1320
taa 1323

<210> 23

<211> 33

<212> DNA

<213> Theileria parva

<400> 23

gtagggtatc caaagggttaa agaagaaatg cta

33

<210> 24

<211> 33

<212> DNA

<213> Theileria parva

<400> 24
agtcatagaag aactaaaaaa attgggaatg cta

33

<210> 25
<211> 33
<212> DNA
<213> Theileria parva

<400> 25
aaatcatcac atggtatggg aaaggtagga aaa

33

<210> 26
<211> 27
<212> DNA
<213> Theileria parva

<400> 26
tttgcacaaa gcctagtgtg cgtatta

27

<210> 27
<211> 27
<212> DNA
<213> Theileria parva

<400> 27
caaagcctag tgtgcgtatt aatgaaa

27

<210> 28
<211> 27
<212> DNA
<213> Theileria parva

<400> 28
actggtgctt ctattcaaac cactctc

27

<210> 29
<211> 27
<212> DNA
<213> Theileria parva

<400> 29
agcaaggctg acgtgatcgc aaagtac

27

<210> 30
<211> 27
<212> DNA
<213> Theileria parva

<400> 30
agcaaggctg acgtgatcgc aaagtac

27

<210> 31
<211> 27
<212> DNA
<213> Theileria parva

<400> 31
tgcggtgctg aattgaacca cttcttg

27

<210> 32
<211> 16
<212> PRT
<213> Theileria parva

<400> 32
Phe Leu Val Gly Tyr Pro Lys Val Lys Glu Glu Met Leu Glu Met Ala
1 5 10 15

<210> 33
<211> 27
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
Primer

<400> 33
ggatccccgg aaaaagaaga ggaactc

27

<210> 34
<211> 24
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
Primer

<400> 34
aatgtagttt tatctaaatt gccca

24

<210> 35
<211> 33
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
Primer

<400> 35
ggatccgaaa tggcgaaaaa taaaggcaaa gga

33

<210> 36
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
Primer

<400> 36
gccagaatt cgatgacatc aaaggacgag

30

<210> 37
<211> 28
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
Primer

<400> 37
ctgcagttaa tttttgaggt aaattttg

28

<210> 38
<211> 25
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
Primer

<400> 38
gaggagataa gttgagagca acatc

25

<210> 39
<211> 31
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
Primer

<400> 39
ctgcagttat aaatcatcga tatcgaaatc t

31

<210> 40
<211> 30
<212> DNA

21/37

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
Primer

<400> 40

ggcgcgggccg cgtcaacttc ctccattttg

30

<210> 41

<211> 24

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
Primer

<400> 41

atggccactt caattgcatt tgcc

24

<210> 42

<211> 24

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
Primer

<400> 42

ttaaataaaa tatttatgag cttc

24

<210> 43

<211> 157

<212> PRT

<213> Theileria parva

<400> 43

Met Arg Val Lys Lys Val Leu Leu Tyr Thr Leu Pro Val Val Gly Ile
1 5 10 15Leu Leu Ala Gly Ser Leu Ile Ile Phe Asn Phe Val Arg Lys Arg Pro
20 25 30Glu Lys Glu Glu Glu Leu Lys Pro Pro Ser Ala Leu Glu Asp Glu Leu
35 40 45Lys Lys Arg Glu Glu Glu Ser Arg Lys Arg Met Glu Glu Met Gln Lys
50 55 60Glu Ile Leu Glu Lys Lys Leu Arg Glu Gly Lys Lys Ala Leu Glu Glu
65 70 75 80

22/37

Leu Leu Ala Gly Ser Leu Ile Ile Phe Asn Phe Val Arg Lys Arg Pro
20 25 30

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<210> 46
<211> 37
<212> PRT
<213> Theileria parva
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<400> 46
Met Arg Val Lys Lys Val Leu Leu Tyr Thr Leu Pro Val Val Gly Ile
  1             5             10             15
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Leu Leu Ala Gly Ser Leu Ile Ile Phe Asn Phe Val Arg Lys Arg Pro
20 25 30

Glu Lys Glu Glu Glu
35

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<210> 47
<211> 66
<212> PRT
<213> Theileria parva
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<400> 47
Met Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp Gly Asp
1 5 10 15

Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu Met Leu
20 25 30

Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu Ile Pro
35 40 45

Ala Pro Pro Gly Val Lys Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr
50 55 60

Ile Thr
65.

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<210> 48
<211> 68
<212> PRT
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24/37

<213> Theileria parva

<400> 48

Met Pro Thr Pro Thr Ile Thr Pro Ser Val Pro Pro Thr Ile Pro
1 5 10 15
Thr Pro Ile Thr Pro Ser Ala Pro Pro Thr Thr Pro Pro Thr Gly Leu
20 25 30
Asn Phe Asn Leu Thr Val Gln Asn Lys Phe Met Ile Gly Ser Gln Glu
35 40 45
Val Lys Leu Asn Ile Thr His Glu Tyr Glu Gly Val Tyr Glu Ala His
50 55 60
Lys Tyr Phe Ile
65

<210> 49

<211> 62

<212> PRT

<213> Theileria parva

<400> 49

Met Gly Val Tyr Glu Ala His Lys Tyr Phe Ile Glu Arg Gly Ser Phe
1 5 10 15
Thr Pro Thr Ser Phe Ser Ile Gly Asp Leu Pro Gln Thr Gly Leu Pro
20 25 30
Val Asn Gln Thr Val Asp Thr Ile Val Val Tyr Phe His Arg Val Thr
35 40 45
Met Gly Glu Pro Val Gly Ile Pro Leu Ile Val Leu Ile Phe
50 55 60

<210> 50

<211> 148

<212> PRT

<213> Theileria parva

<400> 50

Met Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp Gly Asp
1 5 10 15
Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu Met Leu
20 25 30
Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu Ile Pro
35 40 45
Ala Pro Pro Gly Val Lys Pro Glu Ala Pro Thr Pro Thr Thr Ile Thr
50 55 60

25/37

Pro Ser Val Pro Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser Ala Pro
 65 70 75 80

Pro Thr Thr Pro Pro Thr Gly Leu Asn Phe Asn Leu Thr Val Gln Asn
 85 90 95

Lys Phe Lys Phe Met Ile Gly Ser Gln Glu Val Lys Leu Asn Ile Thr
 100 105 110

His Glu Tyr Glu Gly Val Tyr Glu Ala His Lys Tyr Phe Ile Glu Arg
 115 120 125

Gly Ser Phe Thr Pro Thr Ser Phe Ser Ile Gly Asp Leu Pro Gln Thr
 130 135 140

Gly Leu Pro Val
 145

<210> 51
 <211> 121
 <212> PRT
 <213> Theileria parva

<400> 51
 Met Pro Thr Pro Thr Thr Ile Thr Pro Ser Val Pro Pro Thr Ile Pro
 1 5 10 15

Thr Pro Ile Thr Pro Ser Ala Pro Pro Thr Thr Pro Pro Thr Gly Leu
 20 25 30

Asn Phe Asn Leu Thr Val Gln Asn Lys Phe Lys Phe Met Ile Gly Ser
 35 40 45

Gln Glu Val Lys Leu Asn Ile Thr His Glu Tyr Glu Gly Val Tyr Glu
 50 55 60

Ala His Lys Tyr Phe Ile Glu Arg Gly Ser Phe Thr Pro Thr Ser Phe
 65 70 75 80

Ser Ile Gly Asp Leu Pro Gln Thr Gly Leu Pro Val Asn Gln Thr Val
 85 90 95

Asp Thr Ile Val Val Tyr Phe His Arg Val Thr Met Gly Glu Pro Val
 100 105 110

Gly Ile Pro Leu Ile Val Leu Ile Phe
 115 120

<210> 52
 <211> 177
 <212> PRT
 <213> Theileria parva

26/37

<400> 52

Met Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp Gly Asp
 1 5 10 15
 Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu Met Leu
 20 25 30
 Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu Ile Pro
 35 40 45
 Ala Pro Pro Gly Val Lys Pro Glu Ala Pro Thr Pro Thr Thr Ile Thr
 50 55 60
 Pro Ser Val Pro Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser Ala Pro
 65 70 75 80
 Pro Thr Thr Pro Pro Thr Gly Leu Asn Phe Asn Leu Thr Val Gln Asn
 85 90 95
 Lys Phe Lys Phe Met Ile Gly Ser Gln Glu Val Lys Leu Asn Ile Thr
 100 105 110
 His Glu Tyr Glu Gly Val Tyr Glu Ala His Lys Tyr Phe Ile Glu Arg
 115 120 125
 Gly Ser Phe Thr Pro Thr Ser Phe Ser Ile Gly Asp Leu Pro Gln Thr
 130 135 140
 Gly Leu Pro Val Asn Gln Thr Val Asp Thr Ile Val Val Tyr Phe His
 145 150 155 160
 Arg Val Thr Met Gly Glu Pro Val Gly Ile Pro Leu Ile Val Leu Ile
 165 170 175
 Phe

<210> 53

<211> 543

<212> PRT

<213> Theileria parva

<400> 53

Met Arg Val Lys Lys Val Leu Leu Tyr Thr Leu Pro Val Val Gly Ile
 1 5 10 15
 Leu Leu Ala Gly Ser Leu Ile Ile Phe Asn Phe Val Arg Lys Arg Pro
 20 25 30
 Glu Lys Glu Glu Glu Leu Lys Pro Pro Ser Ala Leu Glu Asp Glu Leu
 35 40 45
 Lys Lys Arg Glu Glu Glu Ser Arg Lys Arg Met Glu Glu Met Gln Lys
 50 55 60

27/37

Glu Ile Leu Glu Lys Lys Leu Arg Glu Gly Lys Lys Ala Leu Glu Glu
 65 70 75 80
 Leu Glu Lys Cys Glu Lys Glu Met Val Asp Glu Phe Glu Lys His Leu
 85 90 95
 Lys Lys Pro Glu Glu Arg Leu Pro Lys Ile Ile Leu Ile Leu Asp Ser
 100 105 110
 Gly Phe Pro Thr Val Asp Pro Ile Thr Tyr Thr Ser Gly Val Tyr Met
 115 120 125
 Val Ala Val Ser Lys Thr Thr Phe Thr Ser Asp Ser Asp Leu Val Asp
 130 135 140
 Phe Thr His Thr Leu Leu Gly Ile Lys Phe Leu Val Ala Gly Val Gln
 145 150 155 160
 Phe Gly Gly Lys Thr Tyr Thr Ile Lys Pro Ile Glu Ala Thr Met Ala
 165 170 175
 Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe Leu Leu
 180 185 190
 Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp Gly Asp
 195 200 205
 Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu Ile Ile
 210 215 220
 Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu Ile Pro
 225 230 235 240
 Ala Pro Pro Gly Val Lys Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr
 245 250 255
 Ile Thr Pro Ser Val Pro Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser
 260 265 270
 Ala Pro Pro Thr Thr Pro Pro Thr Gly Leu Asn Phe Asn Leu Thr Val
 275 280 285
 Gln Asn Lys Phe Met Val Gly Ser Gln Glu Val Lys Leu Asn Ile Thr
 290 295 300
 His Glu Tyr Asp Gly Val Tyr Glu Ala His Lys Tyr Phe Ile Glu Lys
 305 310 315 320
 Gly Arg Phe Thr Pro Thr Ser Phe Ser Ile Gly Ala Asp Pro Gln Thr
 325 330 335
 Gly Leu Pro Val Asn Gln Thr Val Asp Thr Ile Val Val Tyr Phe His
 340 345 350
 Arg Val Thr Met Gly Glu Pro Val Gly Ile Pro Leu Ile Val Leu Val
 355 360 365

28/37

Phe Tyr Lys Asn Gln Ser Thr Lys Tyr Leu Asn Lys Gly Asn Gly Asn
370 375 380

Trp Glu Glu Ser Lys Ala Leu Leu Phe Arg Glu Glu Leu Asp Phe Leu
385 390 395 400

Asp Ser Met Phe Asn Gly Tyr Val Thr Val Asn Leu Ser Arg Arg Ser
405 410 415

Asp Tyr Tyr Arg Asn Gly Thr Gly Thr Ser Glu Ile Glu Lys Thr Leu
420 425 430

Asp Met Asn Val Tyr Val Glu Pro Asp Thr Pro Cys Leu Gly Trp Thr
435 440 445

Thr Tyr Ile His Lys Leu Glu Glu Gly Gly Glu Gly Gly Ile Glu Lys
450 455 460

Pro Phe Gln Ile Arg Gln Leu Trp Phe Ser Lys Gln Lys Phe Asp Ile
465 470 475 480

Phe Pro Met Gly Lys Val Ser Ile Val Asn Val Tyr Gly Lys Asn Asp
485 490 495

Glu Pro Leu Ser Tyr Ala Pro Ser Ile Phe Ser Val Ile Arg Glu Asp
500 505 510

Gly Ile Gln Ile Phe Tyr Val Arg Ala Tyr Ser Gln Tyr Leu Leu Asp
515 520 525

Ser Ser Val Asn Pro Gln Asn Leu Pro Gln Lys Leu Thr Ala Glu
530 535 540

<210> 54

<211> 72

<212> PRT

<213> Theileria parva

<400> 54

Met Ala Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe
1 5 10 15

Leu Leu Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp
20 25 30

Gly Asp Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu
35 40 45

Met Leu Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu
50 55 60

Ile Pro Ala Pro Pro Gly Val Lys
65 70

29/37

<210> 55
<211> 72
<212> PRT
<213> Theileria parva

<400> 55
Met Ala Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe
1 5 10 15
Leu Leu Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp
20 25 30
Gly Asp Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu
35 40 45
Met Leu Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu
50 55 60
Ile Pro Ala Pro Pro Gly Val Lys
65 70

<210> 56
<211> 72
<212> PRT
<213> Theileria parva

<400> 56
Met Ala Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe
1 5 10 15
Leu Leu Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp
20 25 30
Gly Asp Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu
35 40 45
Met Leu Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu
50 55 60
Ile Pro Ala Pro Pro Gly Val Lys
65 70

<210> 57
<211> 72
<212> PRT
<213> Theileria parva

<400> 57
Met Ala Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe
1 5 10 15
Leu Leu Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp
20 25 30

30/37

Gly Asp Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu
35 40 45

Met Leu Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu
50 55 60

Ile Pro Ala Pro Pro Gly Val Lys
65 70

<210> 58

<211> 72

<212> PRT

<213> Theileria parva

<400> 58

Met Ala Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe
1 5 10 15

Leu Leu Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp
20 25 30

Gly Asp Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu
35 40 45

Met Leu Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu
50 55 60

Ile Pro Ala Pro Pro Gly Val Lys
65 70

<210> 59

<211> 72

<212> PRT

<213> Theileria parva

<400> 59

Met Ala Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe
1 5 10 15

Leu Leu Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Leu Lys Asn Asp
20 25 30

Gly Asp Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu
35 40 45

Met Leu Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu
50 55 60

Ile Pro Ala Pro Pro Gly Val Lys
65 70

<210> 60

<211> 72

<212> PRT

<213> Theileria parva

<400> 60

Met Ala Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe
1 5 10 15
Leu Leu Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp
20 25 30
Gly Asp Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu
35 40 45
Ile Ile Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu
50 55 60
Ile Pro Ala Pro Pro Gly Val Lys
65 70

<210> 61

<211> 70

<212> PRT

<213> Theileria parva

<400> 61

Met Ala Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Ile Cys Tyr Phe
1 5 10 15
Leu Leu Ile Pro Ala Pro Lys Pro Ile Phe Phe Lys Asn Asp Gly Asp
20 25 30
Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu Ile Ile
35 40 45
Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu Ile Pro
50 55 60
Ala Pro Pro Gly Val Lys
65 70

<210> 62

<211> 72

<212> PRT

<213> Theileria parva

<400> 62

Met Ala Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe
1 5 10 15
Leu Leu Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp
20 25 30
Gly Asp Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu
35 40 45

32/37

Ile Leu Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu
50 55 60

Ile Pro Ala Pro Gly Val Lys
65 70

<210> 63

<211> 72

<212> PRT

<213> Theileria parva

<400> 63

Met Ala Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe
1 5 10 15

Leu Leu Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp
20 25 30

Gly Asp Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu
35 40 45

Ile Leu Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu
50 55 60

Ile Pro Ala Pro Gly Val Lys
65 70

<210> 64

<211> 72

<212> PRT

<213> Theileria parva

<400> 64

Met Ala Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe
1 5 10 15

Leu Leu Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp
20 25 30

Gly Asp Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu
35 40 45

Ile Ile Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu
50 55 60

Ile Pro Ala Pro Gly Val Lys
65 70

<210> 65

<211> 72

<212> PRT

<213> Theileria parva

33/37

<400> 65

Met Ala Thr Ser Ile Ala Phe Ala Ala Asp Pro Gly Phe Cys Tyr Phe
1 5 10 15

Leu Leu Ile Pro Gly Pro Asp Ser Lys Pro Ile Phe Phe Lys Asn Asp
20 25 30

Gly Asp Lys Phe Leu Arg Cys Val Gly Tyr Pro Lys Val Lys Glu Glu
35 40 45

Ile Ile Glu Met Ala Thr Lys Phe Asn Arg Leu Pro Lys Gly Val Glu
50 55 60

Ile Pro Ala Pro Pro Gly Val Lys
65 70

<210> 66

<211> 72

<212> PRT

<213> Theileria parva

<400> 66

Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr Ile Thr Pro Ser Val Pro
1 5 10 15

Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser Ala Pro Pro Thr Thr Pro
20 25 30

Pro Thr Gly Leu Asn Phe Asn Leu Thr Val Gln Asn Lys Phe Met Ile
35 40 45

Gly Ser Gln Glu Val Lys Leu Asn Ile Thr His Glu Tyr Glu Gly Val
50 55 60

Tyr Glu Ala His Lys Tyr Phe Ile
65 70

<210> 67

<211> 72

<212> PRT

<213> Theileria parva

<400> 67

Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr Ile Thr Pro Ser Val Pro
1 5 10 15

Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser Ala Pro Pro Thr Thr Pro
20 25 30

Pro Thr Gly Leu Asn Phe Asn Leu Thr Val Gln Asn Lys Phe Met Ile
35 40 45

Gly Ser Gln Glu Val Lys Leu Asn Ile Thr His Glu Tyr Glu Gly Val
50 55 60

34/37

Tyr Glu Ala His Lys Tyr Phe Ile
65 70

<210> 68
<211> 72
<212> PRT
<213> Theileria parva

<400> 68
Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr Ile Thr Pro Ser Val Pro
1 5 10 15

Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser Ala Pro Pro Thr Thr Pro
20 25 30

Pro Thr Gly Leu Asn Phe Asn Leu Thr Val Gln Asn Lys Phe Met Ile
35 40 45

Gly Ser Gln Glu Val Asn Leu Asn Ile Thr His Glu Tyr Glu Gly Val
50 55 60

Tyr Glu Ala His Lys Tyr Phe Ile
65 70

<210> 69
<211> 72
<212> PRT
<213> Theileria parva

<400> 69
Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr Ile Thr Pro Ser Val Pro
1 5 10 15

Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser Ala Pro Pro Thr Thr Pro
20 25 30

Pro Thr Gly Leu Asn Phe Asn Leu Thr Val Gln Asn Lys Phe Met Ile
35 40 45

Gly Ser Gln Glu Val Asn Leu Asn Ile Thr His Glu Tyr Glu Gly Val
50 55 60

Tyr Glu Ala His Lys Tyr Phe Ile
65 70

<210> 70
<211> 72
<212> PRT
<213> Theileria parva

<400> 70
Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr Ile Thr Pro Ser Val Pro
1 5 10 15

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<210> 71
<211> 64
<212> PRT
<213> Theileria parva
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<400> 71
Pro Glu Ala Pro Thr Pro Thr Pro Thr Pro Ile Thr Pro Ser Ala Pro
1 5 10 15
Pro Thr Thr Pro Pro Thr Thr Pro Pro Lys Gly Leu Asn Phe Asn Leu
20 25 30
Thr Leu Gln Asn Lys Phe Met Ile Gly Ser Gln Glu Val Lys Leu Ser
35 40 45
Ile Thr His Glu Tyr Asp Gly Val Tyr Glu Ala His Lys Tyr Phe Ile
50 55 60

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<210> 72
<211> 72
<212> PRT
<213> Theileria parva
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<400> 72
Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr Ile Thr Pro Ser Val Pro
  1          5          10          15
Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser Ala Pro Pro Thr Pro
  20          25          30
Pro Thr Gly Leu Asn Phe Asn Leu Thr Val Gln Asn Lys Phe Met Val
  35          40          45
Gly Ser Gln Glu Val Lys Leu Asn Ile Thr His Glu Tyr Asp Gly Val
  50          55          60
Tyr Glu Ala His Lys Tyr Phe Ile
  65          70

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36/37

<210> 73
<211> 72
<212> PRT
<213> Theileria parva

<400> 73
Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr Ile Thr Pro Ser Val Pro
1 5 10 15
Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser Ala Pro Pro Thr Thr Pro
20 25 30
Pro Thr Gly Leu Asn Phe Asn Leu Thr Val Gln Asn Lys Phe Met Val
35 40 45
Gly Ser Gln Glu Val Lys Leu Asn Ile Thr His Glu Tyr Asp Gly Val
50 55 60
Tyr Glu Ala His Lys Tyr Phe Ile
65 70

<210> 74
<211> 72
<212> PRT
<213> Theileria parva

<400> 74
Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr Ile Thr Pro Ser Val Pro
1 5 10 15
Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser Ala Pro Pro Thr Thr Pro
20 25 30
Pro Thr Gly Leu Asn Phe Asn Leu Thr Val Gln Asn Lys Phe Met Val
35 40 45
Gly Ser Gln Glu Val Lys Leu Asn Ile Thr His Glu Tyr Glu Gly Val
50 55 60
Tyr Glu Ala His Lys Tyr Phe Ile
65 70

<210> 75
<211> 72
<212> PRT
<213> Theileria parva

<400> 75
Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr Ile Thr Pro Ser Val Pro
1 5 10 15
Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser Ala Pro Pro Thr Thr Pro
20 25 30

37/37

Pro Thr Gly Leu Asn Phe Asn Leu Thr Val Gln Asn Lys Phe Met Ile
35 40 45

Gly Ser Pro Glu Val Lys Leu Asn Ile Thr His Glu Tyr Glu Gly Val
50 55 60

Tyr Glu Ala His Lys Tyr Phe Ile
65 70

<210> 76

<211> 72

<212> PRT

<213> Theileria parva

<400> 76

Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr Ile Thr Pro Ser Val Pro
1 5 10 15

Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser Ala Pro Pro Thr Thr Pro
20 25 30

Pro Thr Gly Leu Asn Phe Asn Leu Thr Val Gln Asn Lys Phe Met Val
35 40 45

Gly Ser Gln Glu Val Lys Leu Asn Ile Pro His Glu Tyr Asp Gly Val
50 55 60

Tyr Glu Ala His Lys Tyr Phe Ile
65 70

<210> 77

<211> 72

<212> PRT

<213> Theileria parva

<400> 77

Pro Glu Ala Pro Thr Pro Thr Pro Thr Thr Ile Thr Pro Ser Val Pro
1 5 10 15

Pro Thr Ile Pro Thr Pro Ile Thr Pro Ser Ala Pro Pro Thr Thr Pro
20 25 30

Pro Thr Gly Leu Asn Phe Asn Leu Thr Val Gln Asn Lys Phe Met Val
35 40 45

Gly Ser Gln Glu Val Lys Leu Asn Ile Thr His Glu Tyr Asp Gly Val
50 55 60

Tyr Glu Ala His Lys Tyr Phe Ile
65 70